APPENDIX 21

FIRE SAFETY REQUIREMENTS FOR MEGA UNDERGROUND DEVELOPMENTS

1 SCOPE

1.1 This guideline provides the broad fire safety requirements for mega underground developments. It is applicable to mega underground developments regardless of size and no. of occupants. Fire safety requirements not covered in this guideline shall comply with the requirements stipulated in the Fire Code.

2 DEFINITIONS

2.1 Basement – Underground levels with connection to the storey above and 1st storey via exit staircases. The exit staircases are the primary means of escape.

2.2 Mega Underground Developments - Underground levels with lifts and/or horizontal access as the primary means of egress. There is no habitable space immediately above the caverns. Exit staircases are not the primary means of escape.

2.3 Cavern unit – An enclosed chamber within the underground developments which is fire compartmented.

2.4 Exit shaft – The main vertical access shaft that leads the underground developments to the ground level.

2.5 Protected corridors – Corridors which link the cavern units to the exit shafts.

3.0 *FIRE SAFETY REQUIREMENTS FOR MEGA UNDERGROUND DEVELOPMENTS*

3.1 ***Means of Escape***

(a) Each underground development shall be provided with at least 2 exit shafts.

(b) At least two exit staircases (at least 1.5m in width but not exceeding 2m) located at the exit shafts shall be provided for the underground development. The width of exit staircases shall be determined by the occupant load and uses of the cavern. The minimum width requirement is not applicable to exit staircases serving the cavern units. Such exit staircases shall comply with the requirements stipulated in the Fire Code.

(c) Fire fighting lobby shall be provided at each exit shaft.

(d) All cavern units shall be provided with at least 2-way escape regardless of whether 1-way travel distance can be complied with.

- One way travel distance shall not exceed 20m
- Two way travel distance shall not exceed 50m

(e) The travel distance is the distance required to be traversed from the most remote point in the cavern to the edge of a fire door opening directly into the protected corridor?

(f) Protected corridors (enclosed by fire rated wall/floor) shall be provided for all cavern units at every storey. The corridor shall have direct access to the protected shaft.

(g) Protected corridors shall be sectorised by fire doors. Each sector shall not consist of more than 4 cavern units or more than 60m (measure along the corridor). Only those doors in the sectors affected by fire need to be closed during activation of alarm.

3.2 *Structural Fire Precautions*

(a) Fire compartmentation shall be provided for each cavern unit. Each compartment shall not exceed 4,000 m^2 & 15,000 m^3.

(b) Different tenancy units shall be compartmented.

(c) The element of structure/compartment of each cavern unit shall have fire resistance rating of at least 4 hrs.

(d) Walls, ceilings, roof covering and finishes shall not contain any plastic material.

(e) Internal non-load bearing walls and ceiling shall be constructed of non-combustible material.

(f) The surface of a wall or ceiling along protected corridor shall have a surface spread of flame of class "0" rating.

(g) The exit staircases shall be constructed of masonry. However if drywall construction is used, the following conditions shall be complied with:

(i) Drywall shall be fire rated and non-combustible;

(ii) Drywall shall meet the criteria, in terms of impact and deflection performance, when subject to the tests of BS 5588 and BS 5234; and

(iii) Drywall shall meet the criteria, in terms of water absorption and bending strength performance, when subject to the test of BS 1230 Part 1 (for gypsum plaster board) or ISO 1896 (for calcium silicate or cement board).

3.3 *Vehicular Access*

(a) Fire engine access road having minimum 4m width and overhead clearance of at least 4.5m for access by pump appliance shall be provided for fire-fighters and rescuers to conduct fire-fighting and rescue operations.

(b) Provision of alternative means of vehicle access into the underground development shall be considered on a case by case basis.

(c) The fire engine access road shall be protected from fire and smoke, and must lead directly to the ground level.

(d) Clear smoke height must be maintained along the access road. Pushing the smoke out directly through the tunnel is not allowed.

(e) Private hydrants shall be provided along the fire engine access road such that every part of the fire engine access road shall be within an unobstructed distance of 50m from the nearest hydrant.

3.4 *Fire–Fighting Provisions*

(a) A room shall be provided to house the fire-fighting & rescue equipment.

Requirements for Storage Area

(i) 2 x storage area per storey, 1 near to each of the exit shaft

(ii) Room size: 2m (width) x 2m (length) x 2.1 m (height)

Items to be kept at the storage area

4 x 64mm hose, 4 x 38mm hose, 1 x dividing breeching 2 x 38mm nozzle, 2 x Breathing Apparatus (BA) Complete

- Premises owner shall provide the fire-fighting equipment

(b) Company Emergency Response Team (CERT) shall be formed for the underground development.

(c) Buggies shall be provided at each level to facilitate fire-fighting and rescue operations.

Requirements for buggies

i. 2 x buggies per level. Each near the rooms storing fire-fighting equipment

ii. 4 seaters

iii. Able to mount 1 x stretcher

iv. Electrically operated

- Premises owner shall provide the buggies.
- The buggies can be used by in-house fire and security personnel provided the buggies are driven back to the holding area during emergency

3.5 *Fire Fighting System, Detection and Alarm*

(a) The underground development shall be protected with automatic sprinkler system.

(b) Wet risers shall be provided such that every part of the underground development is not more than 38m from the nearest wet riser landing valve. The wet riser pipes are allowed to run horizontally but the landing valves shall be located within the protected corridor.

(c) Breeching inlet shall be installed at one of the vertical access shafts at ground level. It shall be located near the Fire Command Centre.

(d) At least two fire lifts shall be provided for each exit shaft. The fire lift shall have access to every habitable floors and shall be adjacent and accessible to an exit staircase and be approached by a fire fighting lobby at each storey. The fire lifts shall home to the ground level (i.e. top of shaft) during activation of alarm and power failure.

(e) All passenger lifts shall be double up as evacuation lift and shall be located within the fire-fighting lobby. They need not be fire lifts but shall be installed with fire switch, connecting to the emergency backup supply, and shall home to ground level in an emergency. The use of these lifts for emergency evacuation shall be supervised by the emergency responders.

(f) The fire lift car shall have a clear area/space of not less than 2.0m (depth) x 1.5m (width).

(g) Water Mist system may be permitted as substitute of automatic sprinklers provided that the requirements stipulated in the fire code are complied with.

(h) Fire Command Centre shall be located at ground level. It shall be located beside one of the protected shaft.

3.6 ***Effective Communication Systems and Holding Area***

(a) Effective communications system shall be provided for MFRS at the underground developments to conduct fire-fighting and rescue operations.

(b) One way emergency communication system such as Emergency Wireless Broadcast System shall be provided for the underground developments. Two way emergency communication system shall be provided between Fire Command Centre and the essential areas stipulated in the Fire Code.

(c) Holding Area shall be provided for the underground development. The size of holding area shall take into considerations the total occupant load within that floor and shall be calculated based on 0.3 sqm/person.

(d) The holding area shall be provided with engineered smoke control system and shall have direct connection to the fire-fighting lobby.

3.7 ***Mechanical Ventilation and Smoke Control System***

(a) Engineered smoke control system shall be provided for the underground development and fire engine access road.

(b) Staircase (meant for rescue/evacuation purposes)/smoke stop lobby/fire-fighting lobby shall be pressurized.

(c) The air-handling system for the affected smoke zone and the adjacent zones must be shut down to avoid smoke re-circulating through the system.

3.8 ***Restriction of Hazardous Materials***

(a) Hazardous, flammable and combustible materials shall be prohibited or controlled strictly if they have to be used within the facilities.

(b) If small quantities are needed, special approval has to be obtained from MFRS.

3.9 ***Provision for Emergency Directional Signages /Generator***

(a) Photo luminescent marking/tape to guide occupants along evacuation routes to appropriate exit shall be provided:

i. along internal walls and/or floors of the exit staircase and protected lobby;

ii. at the exit staircase door;

iii. in designated corridor with exit directional sign.

(b) The duration for standby generator shall be in accordance with the requirements stipulated in the BS or any relevant Standard.

(c) Lifts at the cavern units shall be connected to the standby generator.

3.10 ***Training and Other Safety Requirements in Caverns***

(a) All staff in the underground development are required to be properly and thoroughly briefed on the Fire Emergency Plans.

(b) All staff shall be trained on basic fire-fighting and rescue matters. Safety hoods shall be equipped and provided for each working occupant in the caverns.

(c) Fire safety report shall be submitted to MFRS. Fire escape plan shall be provided at the common areas.